Status of plasma turbulence simulation studies in LAPD

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An ongoing effort on numerical simulations of plasma turbulence in the Large Plasma Device (LAPD) is reviewed and extended in this work. Previously, a 3-D, three-field Braginskii-based fluid plasma model with density-gradient drive was used in the BOUT code to simulate a particular configuration of the plasma in LAPD [1,2]. Using a newer and improved code BOUT++ [3] the model is extended to include temperature fluctuations, axial boundary conditions, and realistic boundary-induced flows. Verification and validation of the code and the implemented physics model are explored in this work. A grid convergence study shows that adding a small artificial perpendicular diffusion term to the model causes convergence of calculated turbulence spectra. Numerical and analytic computations of linear growth rates of the conducting wall mode [4] verify implementation of the sheath boundary conditions in the code. The validation effort compares experimental observables such as frequency spectra and correlation lengths to those in the simulation, showing qualitative and semi-quantitative agreement. The role of stable eigenmodes in saturation of turbulence is investigated.

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